OA 3302
Winter 2003

Simple Inventory System

Setting

A company is seeking to manage the inventory level for a single product. Customers purchasing the product arrive according to an arrival process $\{t_A\}$. Each arriving customer attempts to purchase a random number of items, D. The inventory level at the company is reviewed periodically and a decision is made whether or not to place an order from its supplier. When the company places an order, it takes a certain amount of time ("lead time") for the order to arrive. Due to a variety of circumstances, the lead times are random. The company uses a <s,S> policy for its ordering decisions. If the inventory position at review time is below s, then an order is placed that is the difference between it and the number S. The inventory position includes the amount of the product on-hand and the amount of the product that is on-order (that is, has been ordered from the supplier but not yet received).

When a customer's order cannot be filled, the unfilled portion is put on backorder. When the company receives a shipment from its supplier, backorders are immediately filled and the remainder put in stock. For example, if there are 5 items in stock and a customer wants to buy 8 items, the customer is given the five items in stock and the remaining three are backordered.

Extensions

1. *Adding costs.* Every time an order is placed with the supplier, it costs the company a fixed amount, K, plus C per item ordered which is incurred when the order is received. Each item that is held in stock at the company incurs a "holding cost" of \$$h$ per unit time, which starts as soon as the item is placed in inventory and ends when the item is sold. Each item that is on backorder incurs a shortage cost of \$$\pi$ per unit time, which starts as soon as the item is backordered and ends when the backorder is fulfilled.

2. *Perishable items.* After a certain amount of time on the shelf, items spoil and must be discarded. An item is not discovered to have spoiled until it is taken from inventory for a customer. In general, different items will have different shelf lives.

3. *Fixed Batch sizes.* All orders from the supplier must be purchased in batches of size B. Each order therefore, when placed after a review, is of size nB, where n is the largest integer such that $nB \leq$. S

4. *Fixed Order Quantity.* Instead of ordering "up to" S, each time an order is placed it is a fixed quantity Q. That is, when inventory is reviewed, if the inventory position is less than r, then an order for an amount Q is placed.